

REMARKS

Claim 1 has been amended to delete the metals Cr, V, and W from the first electrode layer. New claims 8-11 have been added. New Independent claim 8 has been added. Independent claim 8 changes claim 1 to claim only metals that have a free energy of nitride formation of less -51 kcal/mol. Formation free energies are known to those in the art. Claims 9-11, which depend upon claim 8 correspond to pending claims 2-5. No new matter has been added to the application.

Claim 5 is objected to because, according to the Examiner, “[t]he expression of ‘nitride of a metal included in said first metal group’ is misdescriptive because nitride is not a metal.” The Examiner has misread the claim. Claim 5 claims a “nitride of a metal included in said first metal group,” not a “nitride metal included in said first metal group.” Nitrides can include metallic components. Applicant is claiming nitrides that have specific metallic components. It is the metallic component that is included in the first metal group, not the nitride.

Claims 1-4 stand rejected under 35 USC 102(b) as being anticipated by Kim. As amended, the claims are patentable over Kim. Kim discusses contacts using a Cr/Ni/Au or a Ni Cr/Au metallization scheme. Kim does not disclose using any other specific metal nitrides.

Independent claim 1 has been amended to delete the metals Cr, V, and W from the first electrode layer. As described in the specification, the first electrode layer combines with nitrogen to form a metal nitride. See, for example, page 3, lines 27-30. Applicant has found that the formation of this nitride layer creates many of the beneficial characteristics of the present invention. As described on page 6, lines 12-14, of the specification, the formation of this nitride layer inhibits the formation of a Ni-N layer which causes higher resistance and instability of the electrode structure. Accordingly, metals that form stable nitride compounds are preferred in this invention since they form more stable electrode structures. The free energy of formation (ΔG : kcal/mol) for the metal nitrides described in the application are -74 for Ti; -81 for Hf; -87 for Zr; -35 for V; -51 for Nb; -54 for Ta; -24 for Cr; -11 for W; and -61 for Sc.

In the preferred embodiment of the present invention, a first electrode layer of Ti ($\Delta G = -74$ kcal/mol) is disclosed. Metals (i.e., Hf, Zr, Nb, Ta, and Sc) having a free energy of formation (ΔG) less than -50 kcal/mol, like Ti, are also preferable. However, metals that have a free energy of formation greater than -50 kcal/mol (i.e., V, Cr, and W) can also form nitrides, but such nitrides are not as stable. Accordingly, applicant has amended the claims to cover only these preferred metals.

The Kim reference does not describe using any of the preferred metals as an electrode layer. The Kim reference only describes using a Cr layer, which is no longer claimed by applicant. Claim 1 is therefore patentable over the Kim reference. Claims 2 and 3, which depend upon claim 1, are patentable for at least the same reasons.

Claim 5 is rejected under 35 USC 103(a) as being unpatentable over Kim. As described above, claim 1 has been amended and is now patentable over Kim. Claim 5, which depends upon amended claim 1, is patentable for at least the same reasons as claim 1.

For the foregoing reasons, early action allowing claims 1-5 in this application is solicited.

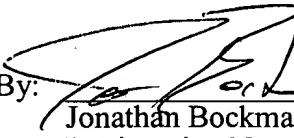
Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version with markings to show changes made".

In the event that the transmittal letter is separated from this document and the Patent and Trademark Office determines that an extension and/or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952** referencing docket no. 245402001600. However, the Commissioner is not authorized to charge the cost of the issue fee to the Deposit Account.

Respectfully submitted,

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~~VERSION WITH MARKINGS TO SHOW CHANGES MADE~~

In the Claims:

Please amend claim 1 as follows:

1. (Amended) An electrode structure on a p-type III group nitride semiconductor layer, comprising first, second and third electrode layers successively stacked on said semiconductor layer,

 said first electrode layer including at least one selected from a first metal group of Ti, Hf, Zr, [V,] Nb, Ta[, Cr, W] and Sc,

 said second electrode layer including at least one selected from a second metal group of Ni, Pd and Co, and

 said third electrode layer including Au.

Please add the following claims:

8. (New) An electrode structure on a p-type III group nitride semiconductor layer, comprising first, second and third electrode layers successively stacked on said semiconductor layer,

 said first electrode layer including at least one metal having a free energy of nitride formation of less -51 kcal/mol,

 said second electrode layer including at least one selected from a second metal group of Ni, Pd and Co, and

 said third electrode layer including Au.

9. (New) The electrode structure according to claim 8, wherein said first electrode layer has a thickness in a range from 1 to 500 nm.

10. (New) The electrode structure according to claim 8, wherein said second electrode layer has a thickness of 5 nm or more.

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11. (New) The electrode structure according to claim 8, wherein said third electrode layer has a thickness of 50 nm or more.